



# FOREST CONTROL

*by*

# CONTINUOUS INVENTORY

"Today I have grown taller from walking  
with the trees."

...Karle Wilson

Milwaukee, Wis. April, 1962 No. 97

"When there is an income tax  
the just man will pay more and  
the unjust less on the same  
amount of income."

PLATO

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4/16/62

THE NEW LARGE COMPUTERS REQUIRE NEW CFI FORMULAS  
FOR VOLUME, BASAL AREA AND DBH CLASS

These are the exciting and interesting days of new style computers operating on the stored program data processing principle. Replacing calculating punches at a rapid rate in the Lake and Central States, these more flexible computers permit major improvements in machine planning. Data processing work on three or four industrial CFI cases in Region 9 this year will be done by stored program methods. Perhaps the greatest improvement will occur in the speed of the calculation of individual tree volumes. However, use of the newer computers makes it necessary to apply volume formulas which differ from those previously used with the calculating punch.

Our choice of formulas for computing tree volumes on the newer machines goes back to the original work on volume tables by Suren R. Gevorkiantz and Lucille P. Olsen. The chief objective is to secure formulas which fit closely the 1955 volume tables published in Lake States Forest Experiment Station Bulletin No. 1104.

A cordwood formula and test comparisons are given with this Newsletter. Prepared by Gevorkiantz in the early days of composite volume tables, this prescription for tree volumes has been used in the Lake States with efficiency and success. Close correlation between formula and table is apparent in the 6" through 10" diameter class range from which more than two-thirds of the pulpwood volume in the Lake States is cut. Deviations are greater, but nevertheless acceptable, in trees of larger sizes.

Changing machine method and volume formula between successive measurements does create a problem; the original and currently computed volumes of trees of given diameter and length classes are not quite comparable. Differences are slight but sufficient to affect the growth results between CFI inventories. There is a solution to the problem. In tests of the new method thus far, comparability has been assured by repeating the computation of the original tree volumes with the new prescription. This is done for both sets of records simultaneously and at great output speeds. Under this practice the problem is then reduced to programming for two calculations in one pass through the computer. Basal area and DBH class are also computed at this time and the formulas are attached.

A proposed sawlog volume formula and supporting correlations with Bulletin 1104 volumes will be ready in time for the next Newsletter.

CAL STOTT  
Forester

4/16/62

EXHIBIT I

FORMULA FOR COMPUTING THE CORD VOLUME OF PULPWOOD TREES

BASIS: Bulletin 1104. Composite Volume Tables for Timber and Their Application in the Lake States. S. R. Gevorkiantz and L. P. Olsen, L.S.F.E.S. - Forest Service.

(THE FORMULA)

$$V_c = (0.001D^2) (1.9 + 0.01D) (0.026H - 0.000156H^2 + \frac{0.32}{H})$$

Calculated Volumes are also multiplied by Species and Soundness Correction Factors as shown in the Example.

(IN WHICH)

V<sub>c</sub> = Volume Cords

D<sup>2</sup> = DBH Squared

D = DBH

H = Usable Length

H<sup>2</sup> = Usable Length Squared

For converting VC to Cu. Ft. multiply by 79.

(THE EXAMPLE)

Cordwood Volume Per Tree

DBH = 8.0 inches

Usable Length = 32 feet

Soundness = 0.97 percent

Species Factor = 1.03

(THE SOLUTION)

$$V_c = (.001 \times 64)(1.9 + .01 \times 8) \left\{ .026 \times 32 - .000156 \times 1024 + \frac{.32}{32} \right\} (1.03)(0.97)$$

$$V_c = (.064) (1.98) (.832 - .159744 + .01) (1.03) (0.97)$$

$$V_c = (.064) (1.98) (.682256) (1.03) (0.97)$$

$$V_c = .086378 \text{ or } .086 \text{ cords}$$

4/16/62

EXHIBIT II

FORMULA FOR COMPUTING THE BASAL AREA OF TREES

(THE FORMULA)

$$BA = .005454D^2$$

(IN WHICH)

BA = BASAL AREA

Constant = .005454

$D^2$  = DBH Squared

EXHIBIT III

FORMULA FOR COMPUTING DBH CLASS

(2-INCH DBH CLASS)

If whole number of DBH is even, PUNCH IT.

e.g., 06 = 06 DBH Class  
12 = 12 DBH Class

If whole number of DBH is uneven, ADD 1 AND PUNCH THE SUM

e.g., 05 + 1 = 06 DBH Class  
11 + 1 = 12 DBH Class

(1-INCH DBH CLASS)

If decimal is .6, .7, .8, or .9, ADD 1 TO WHOLE NUMBER AND PUNCH THE SUM.

e.g., 05.6 + 01.0 = 06 DBH Class  
11.9 + 01.0 = 12 DBH Class

If decimal is 0, .1, .2, .3, .4, or .5, PUNCH THE WHOLE NUMBER DIRECT.

e.g., 06.0 = 06 DBH Class  
12.5 = 12 DBH Class

VOLUME COMPARISON  
CORDWOOD VOLUME TABLE AND FORMULA

EXHIBIT IV

DBH	Source	1 8'	2 16'	3 24'	4 32'	5 40'	6 48'	7 56'	8 64'
6	Formula	.017	.028	.039	.048				
	Bul. 1104	.017	.028	.040	.047				
8	Formula	.030	.050	.069	.086	.101	.113		
	Bul. 1104	.031	.050	.068	.087	.106	.116		
10	Formula	.048	.079	.109	.136	.160	.179	.194	
	Bul. 1104	.049	.082	.111	.133	.160	.188	.211	
12	Formula	.069	.115	.159	.198	.232	.260	.283	.300
	Bul. 1104	.070	.121	.165	.198	.225	.260	.300	.330
14	Formula	.095	.158	.219	.273	.319	.358	.389	.412
	Bul. 1104	.095	.167	.228	.273	.311	.353	.400	.470
16	Formula	.126	.209	.289	.360	.421	.472	.513	.543
	Bul. 1104	.122	.220	.300	.367	.420	.470	.530	.590
18	Formula	.160	.267	.369	.460	.538	.603	.655	.694
	Bul. 1104	.155	.282	.382	.470	.550	.600	.650	.730
20	Formula	.200	.333	.460	.573	.671	.752	.817	.865
	Bul. 1104	.194	.353	.480	.590	.680	.760	.810	.890
22	Formula	.244	.406	.561	.700	.819	.919	.998	1.057
	Bul. 1104	.240	.440	.600	.730	.840	.930	1.000	1.070
24	Formula	.293	.488	.674	.841	.984	1.104	1.199	1.270
	Bul. 1104	.288	.520	.720	.880	1.000	1.120	1.210	1.280
26	Formula	.348	.578	.799	.996	1.166	1.307	1.420	1.504
	Bul. 1104	.340	.620	.840	1.040	1.190	1.330	1.440	1.510
28	Formula		.677	.935	1.166	1.365	1.530	1.662	1.760
	Bul. 1104		.720	.970	1.200	1.380	1.550	1.670	1.760
30	Formula		.784	1.083	1.351	1.581	1.773	1.926	2.039
	Bul. 1104		.800	1.100	1.370	1.590	1.700	1.930	2.040

Bulletin 1104, Published by the L.S.F.E.S. Forest Service. Written by  
S. R. Gevorkiantz and L. P. Olsen.

4/16/62

DEVIATIONS OF FORMULA VOLUMES IN CORDS FROM BULLETIN 1104EXHIBIT IV

DBH	Deviations in Volume and Percent	1	2	3	4	5	6	7	8
		8'	16'	24'	32'	40'	48'	56'	64'
6	Volume	0	0	-.001	+.001				
	Percent			-2.5%	+2.1%				
8	Volume	-.001	0	+.001	-.001	-.005	-.003		
	Percent	-3.2%	0	+1.5%	-1.1%	-4.7%	-2.6%		
10	Volume	-.001	-.003	-.002	+.003	0	-.009	-.007	
	Percent	-2.0%	-3.7%	-1.8%	+2.3%	0	-4.8%	-3.3%	
12	Volume	-.001	-.006	-.006	0	+.007	0	-.017	-.030
	Percent	-1.4%	-5.0%	-3.6%	0	+3.1%	0	-5.7%	-9.1%
14	Volume	0	-.009	-.009	0	+.008	+.005	-.011	-.058
	Percent	0	-5.4%	-3.9%	0	+2.6%	+1.4%	-2.8%	-12.3%
16	Volume	+.004	-.011	-.011	-.007	+.001	+.002	-.017	-.047
	Percent	+3.3%	-5.0%	-3.7%	-1.9%	+0.2%	+0.4%	-3.2%	-8.0%
18	Volume	+.005	-.015	-.013	-.010	-.012	+.003	+.005	-.036
	Percent	+3.2%	-5.3%	-3.4%	-2.1%	-2.2%	+0.5%	+0.8%	-4.9%
20	Volume	+.006	-.020	-.020	-.017	-.009	-.008	+.007	-.025
	Percent	+3.1%	-5.7%	-4.2%	-2.9%	-1.3%	-1.1%	+0.9%	-2.8%
22	Volume	+.004	-.034	-.039	-.030	-.021	-.011	-.002	-.013
	Percent	+1.7%	-7.7%	-6.5%	-4.1%	-2.5%	-1.2%	-0.2%	-1.2%
24	Volume	+.005	-.032	-.046	-.039	-.016	-.016	-.011	-.010
	Percent	+1.7%	-6.2%	-6.4%	-4.4%	-1.6%	-1.4%	-0.9%	-0.8%
26	Volume	+.008	-.042	-.041	-.044	-.024	-.023	-.020	-.006
	Percent	+2.4%	-6.8%	-4.9%	-4.2%	-2.0%	-1.7%	-1.4%	-0.4%
28	Volume		-.043	-.035	-.034	-.015	-.020	-.008	0
	Percent		-6.0%	-3.6%	-2.8%	-1.1%	-1.3%	-0.5%	0
30	Volume		-.016	-.017	-.019	-.009	+.073	-.004	-.001
	Percent		-2.0%	-1.5%	-1.4%	-0.6%	+4.3%	-0.2%	-Neg.